the Proceedings of the American Academy of Arts and Sciences, and in the publications of the United States National Museum. His collections, both botanical and ethnological, have been remarkable, not for the prettiness of the various objects, but for the completeness of the material and the care shown in his notes.

He continued his chosen work to the very end. His last exploration was in 1910, in the vicinity of Tampico, on the gulf coast of Mexico. After his return he occupied himself in assorting and distributing his material. On the occasion of the eightieth anniversary of his birth, the Botanical Society of Washington held a special meeting in his honor, at which a paper on his life and work by the author of the present sketch was read, together with letters written by various eminent men of science not residing in Washington. During the meeting of the society Dr. PALMER was seated in the place of honor, and at the close of the exercises he was presented with an appropriate birthday gift as a token of the appreciation of the members of the society of his important life-work. The venerable traveler received the congratulations of those present with tears streaming down his cheeks, doubtless realizing that this must be his valedictory.—W. E. SAFFORD, *Department of Agriculture, Washington, D.C.*

DEHYDRATING WITH ALCOHOL

(WITH FOUR FIGURES)

The difficulty which undergraduate students who take courses in histology find in giving regular attention to dehydration, led me to a search for an automatic method. Osmotic means were rejected because they are uncontrollable and give no indication of the stage of the process. Work on the principle of slowly adding alcohol of increasing strength to the tissue developed the simple apparatus shown in fig. 1. During the past two years this apparatus has been used for dehydrating all kinds of plant tissue for histology and embryology. It has also been used instead of glycerin in preparing algae to be mounted in Venetian turpentine.

The alcohol from the supply bottle drops from the lower end of the "capillary" *v* into the thistle tube, which conveys it to the bottom of the mixing tube *B*. The alcohol diffuses with the water in *B*, and the increase in volume is carried to the dehydrating tube *C* through the connecting tube *x*. Naturally, as more alcohol is added to *B*, the strength of the liquid passing into *C* increases, but as that in *B* is always

only slightly stronger than that in *C*, the tissues which are placed in *C* are not injured. In cases where extraordinary care is needed, it may be desirable to keep the tissues some distance from the opening through which the alcohol enters *C*. The siphon *y* removes the excess of

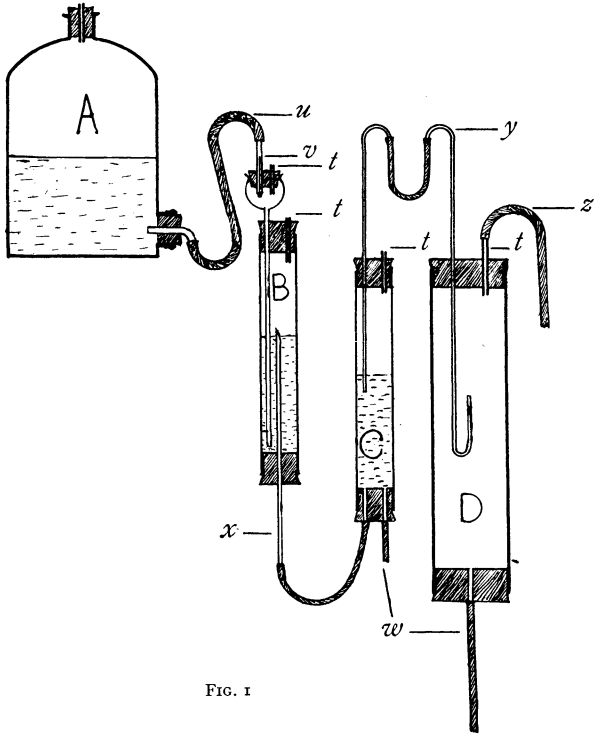

FIG. 1

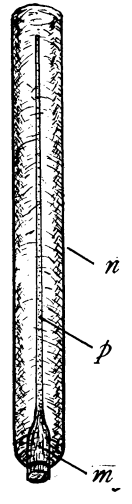

FIG. 2

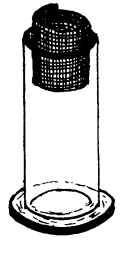

FIG. 3

FIGS. 1–3.—Fig. 1, *A*, supply bottle; *B*, mixing tube; *C*, dehydrating tube; *D*, waste tube; *t*, *t*, capillary tubes (air vents); *u*, supply tube; *v*, "capillary"; *x*, overflow; *y*, siphon; *z*, tube for starting siphon; fig. 2, "Capillary" on a larger scale: *n*, large tube; *m*, smaller tube, drawn to capillary (*p*) and sealed into lower end of *n;* fig. 3, washing jar with gauze neck.

dilute alcohol from *C*. The bent end of the siphon in the waste tube *D* prevents the automatic emptying of the siphon. When the apparatus is to be used, tissues and water are placed in *C*, and an equal volume of water is placed in *B*. The overflow *x* and the siphon *y*, which is filled by withdrawing the air from *D* through the tube *z*, are set to keep these volumes constant. The flow of alcohol is started by remov-

ing the "capillary" and supply tube from the thistle tube and letting them hang downward from the supply bottle for a minute to expel all the air from them.

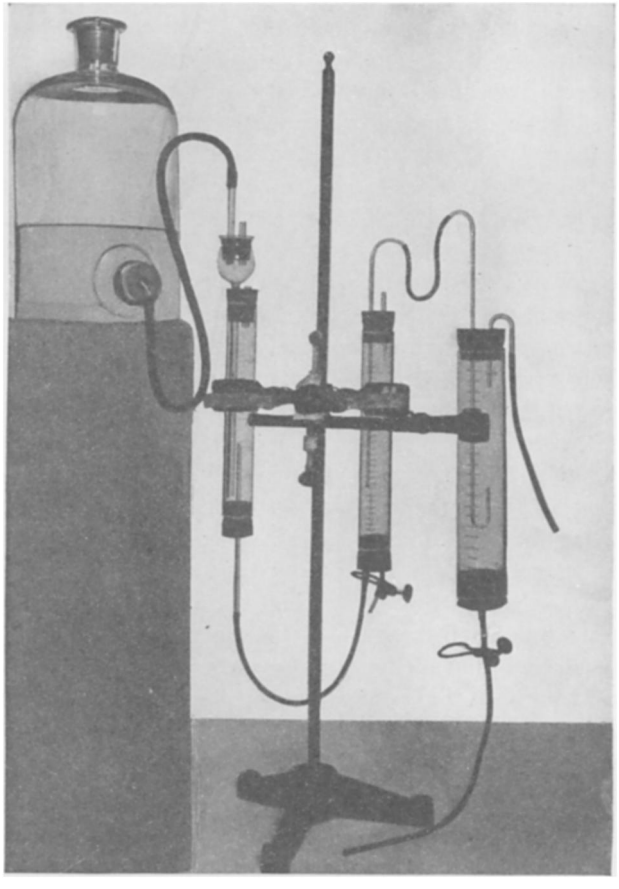

FIG. 4.—Photograph showing supports: to the stem of the double burette clamp, which holds the mixing and dehydrating tubes, is attached a single clamp which holds the waste tube.

Mathematical calculations, as well as numerous picnometer tests, show that the percentage of alcohol in *C* increases very steadily to about 75 per cent. Calling the contents of *C* one volume, the picnometer tests show that two volumes of 95 per cent alcohol will raise the strength of that in *C* to 70 per cent, three volumes to 85 per cent, and four to 92

per cent. However, most tissues may be taken from 85 per cent alcohol and covered with that remaining in *B*, and then transferred from that to either 95 per cent or absolute alcohol.

The flow of alcohol is insured against varying vapor pressures by the short capillary tubes in the stoppers which close the upper ends of the larger tubes, or if suitable capillary tubing cannot be obtained ordinary glass tubes nearly sealed at both ends will do quite as well. In either case the slightest amount of water in them renders them worthless. The "capillary" is shown at *v*, and enlarged in fig. 2. It is made by sealing within a larger glass tube a small one first drawn out to a very fine capillary. With a head of 40 or 50 cm. it should allow several drops of alcohol to flow per minute. If the flow is too slow, the small end of the fine capillary may be broken off with a pair of forceps. Otherwise the flow is regulated by raising either the supply bottle or the remainder of the apparatus, which is clamped on the ring stand. As a drop of alcohol from *v* per minute means 1 cc. per hour, and most material may be dehydrated in 40 hours or less, it is easy to adjust the flow, and the apparatus needs no further attention until its part of the process is complete. *B* and *C* may each conveniently be ordinary glass tubing 15 cm. long and 2.5 cm. in diameter. *D* is of similar material twice this diameter and 5 cm. longer. It is very convenient to have all three of these tubes graduated. The supply tube should be at least 6 mm. inside diameter, so that, when starting, the alcohol will readily replace the air in it; but, as the contents of the other connections are added to the waste alcohol and dehydration is delayed by the contents of *x*, these should not be over 1.5–2 mm. inside diameter. It seems that only the best antimony rubber tubing will withstand alcohol. Ordinary physicians' catheters, one large and two small, will furnish all of this tubing that is needed.

In practice it is convenient, after killing is complete, to tie the tissue with a label number in a square of fine silk gauze (chiffon). Knots are unnecessary; after the corners of the gauze are brought together a half dozen turns of very fine cotton thread will hold very well. A number of samples may then be washed very effectively under a small tap, in a jar the neck of which is provided with a cylinder of wire gauze as shown in fig. 3. After washing, the samples are transferred to the dehydrator and may afterward be kept in one or at least very few dishes until infiltrated with paraffin. The silk gauze also protects the samples from the air while they are being transferred to the imbedding dish, where it may be cut and the pieces of tissue and label properly arranged.—

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